

Guadalhorce Watershed

Justicia Hidrica

Research Report

Saskia van der Kooij

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Table of Contents

1 Introduction.....	5
2. Methodology	6
2.1 Conceptual framework.....	6
2.1.1 Echelons of Right Analysis	6
2.1.2 Accumulation, conflicts and reactions of civil society	7
2.1.3 Watersheds	7
2.2 Methods	8
2.2.1 interviews	8
2.2.2 Participant observation	8
2.2.3 Flow measurements	9
2.3 Epistemology	9
3. Research Background	11
3.1 Guadalhorce watershed	11
3.2 Spanish and Andalucía water policy.....	12
3.3 history Guadalhorce Watershed	14
3.3.1 Hydraulic paradigm	15
3.5 Actual Situation	18
4. Water Use Actors	19
4.1. Irrigators (agriculture)	19
4.1.1 Guadalhorce Irrigation System and small scale irrigation systems	20
4.1.2 A wide variety: from entrepreneurs to recreational farming	20
4.2. EMASA (drinking water sector)	25
4.3 ENDESA (industry)	26
4.4 golf courses (recreation)	27
4.5 Environment.....	28
5. Case studies.....	29
5.1 Rural versus urban.....	31
5.1.1 Accumulation	31
5.1.2 Conflict	31
5.1.3 Civil society action.....	33
5.2 Overexploitation of the urban periphery.....	35
5.2.1 Accumulation	35
5.2.2 Conflict	37
5.2.3 Civil Society Action	38
5.3 Giri's in a local System.....	39
5.3.1 Accumulation	39
5.3.2 Conflict case	40
5.3.3 Civil Society Action	42
6 Conclusion	43

List of abbreviations

GIS	Guadalhorce Irrigation System
WUA	Water Users Organization
AAA	Andalucía Water Agency
ERA	Echelons of Right Analysis



Figure 1. Sketch of the Guadalhorce watershed

1 Introduction

The Costa del Sol has promoted itself with an image of tourism, construction of holiday houses and recreation. That agriculture is still executed in many areas is often forgotten. All attention goes to urban areas, and so does the water distribution. The water in the three reservoirs in the Guadalhorce watershed gets distributed over energy centrals, agriculture and drinking water for Malaga city. Drinking water has the highest priority by law, and also most investments are done in the infrastructure of the drinking water system. Farmers in the countryside get less water than they need; in dry years only an 'emergency irrigation turn' will be given, which is hardly enough to keep fruit trees alive. In the mountainous areas the relatively small-scale agriculture cannot compete on the world market; oranges for example can be produced for a lower price in Morocco. Youngsters are more and more disinterested in agriculture, and retired farmers can not easily find some-one who will take over the care for the land. Different options exist, farmers shift to organic farming, greenhouses and cultivation of tropical fruits to survive. Many farmers stop cultivating their lands, and their farms will not be bought for agricultural purposes, but rather for the expansion of urban areas and for recreational purposes which are much more profitable in economic terms. Especially holiday houses, residential areas and recreational centers have been expanding in the area, and claim a large share of the scarce water.

Protests of the farmers against the unfair water distribution get hardly heard, the couple of initiatives from the irrigators of the large-scale irrigation scheme have not had much impact on the actual water distribution. In the sub-watershed of the Rio Grande however, where EMASA, the drinking water company, wanted to construct another dam, the protest did get response and the dam construction has been halted so far.

This shift from agriculture to 3rd service economy does have a positive impact on the economy, but is an extra threat for the remaining farmers, especially caused by the extensive water use of the recreational sector. Golf courses, urban parks and domestic water use put a different demand (in terms of quality, quantity and timing) on the existing water providing technologies and institutions. Their requests often get a higher priority as these new land uses are coupled to economic prosperity, which is favorable for the governmental institutions, especially now, in a period of economic crisis. But these competing claims on water, and the un-equal distribution among users, cannot be justified by economic successes. It is a must to get insights in the processes of water accumulation of all parties, and to understand the conflicts which arise from these. While studies on water justice have mainly focused on developing countries, water injustice seems to exist in the developed world as well.

I will make an attempt to create insights in the water distribution in the Guadalhorce watershed. I will do so with an explorative study of current processes and dynamics of water accumulation. To do this, I will describe the situation of the watershed in general, and I will go in-depth in 3 case studies in specific. As such, a general view can be sketched, which enables us to critically reflect on the current situation of water rights in the Guadalhorce watershed.

2. Methodology

2.1 Conceptual framework

This research is carried out within the framework of the *Justicia Hidrica* project. This project has set out a conceptualization, which is used within this research. The conceptual framework of all the researches carried out within this project is similar to enable comparison between different watersheds and countries. Below, I will shortly describe this conceptual framework of the Justicia Hidrica project.

2.1.1 Echelons of Right Analysis

As an approach to study water justice, this project uses the Echelons of Rights Analysis. According to Boelens, 2008, p.50, Echelons of Right Analysis are:

‘Along with the struggle over water, infrastructure, and other material means (Resources), at a second abstraction level there is the contest over the formulation and contents of water rights and operational norms (Rules) the third level deals with the struggle over decision-making authority and the legitimacy of right systems (regulatory control). The fourth level analyses the diverging discourses that defend or challenge particular water policies, normative constructs and water hierarchies (Regimes of Representation)’

This approach enables us to look beyond equity in formal rights to water only: it rather includes the wide array of rights to water, from access to resources, to norms and rules in use, legal authority and justifiable use within dominant discourses. Furthermore, the ERA approach enables us to define water justice at different levels: at the level of the investigator him/herself, at the level of the actors themselves and also at the level of the water justice project. As such, water justice goes beyond the notion of equity, and rather discusses perceived water justice on different levels – and also the structural contradictions between these.

These two access (space in which water justice is determined and plural rights) can be summarized in a matrix as elaborated for the Justicia Hidrica project:

Level of Echelons of Right Analysis	Official Justice (norms, policy)	Social Justice		
		Justice, following the concepts of the researcher	Concepts and notions of justice expressed by actors	General concepts of water justice, as developed by the JH project
Access to resources: natural resources, infrastructure, technology, economic resources				
Norms and rules				
Legitimate authority				
Use of discourses				

Figure 2. Echelons of right analysis, copied from Justicia Hídrica 2009 (informe aportes conceptuales y estratégicos para la implementación del proyecto Justicia Hídrica), own translation.

Within this framework, some themes will be cross-cutting the different echelons. Themes like these are for example interculturality and gender. Within this research, I do not plan to literary fill in this table, I rather use this as a reference, to check whether all elements of water justice are discussed, and to select case studies which cover the whole array of water justice.

2.1.2 Accumulation, conflicts and reactions of civil society

The water justice question in the Guadalhorce Watershed has its origin in historic processes of water access and rights distribution. Within the current water distribution, dominant discourses from the 20th century are reflected, and still play a role. This current water distribution results in a situation in which some accumulate more water than others, and can only be understood by tracing back the history of water management in the area – and Spain in general.

Water injustice in the area is not a new issue, it is already contested over a long period. Within this study, I have chosen to look at the time from 2003 to now to analyze water conflicts, as in 2003 a water scarce period started which has put current water distribution under pressure – which would increase existing water injustice and thus conflicts could escalate.

When conflicts escalate, people take action. The selection of case studies in this report will describe the type of actions that people take, some at the individual level, some take action at international level, and most often, action is taken on different levels in order to spread chances.

2.1.3 Watersheds

As a unit of analysis, I use the Guadalhorce Watershed. This has several advantages but also some disadvantages. On the one hand, a watershed is a very clear way to mark an area, as natural features such as mountains and rocks mark the borders. During interviews, it is easy to stand in the field and to point out the borders of the area. Furthermore, as different investigators use a watershed as unit of analysis, it is a good way to compare data. However, the Guadalhorce Watershed is somewhat ambiguous: I myself have set the border at the dams of the reservoirs, as from there downwards the water distribution gets highly contested. From a purely hydrology point of view however, I should have included the upstream area of the dams as well, which would have been a too large area to investigate. Furthermore, the boundaries of a watershed do not well capture flows of humans and flows of groundwater. Because of this limitations, I have sometimes ‘allowed myself to look beyond the borders of the watershed’, to understand for example the groundwater use of Benidorm’s tourist industry (using groundwater of the Sierra de los Mijas, partly in the Guadalhorce watershed) or the work migration processes towards Malaga city.

To describe the conflicts and the (re) actions of civil society in the watershed, I will use case studies. These case studies are selected as such, that the wide array of water injustices become alive for the reader.

2.2 Methods

2.2.1 interviews

The fieldwork for this research is carried out in August/September 2009 in a period of 5 weeks, and the main method used is interviews. An overview of all the activities are captured in a research journal. As the Wageningen University has been carrying out practical courses in this area, I could base my study on several student reports, which gave me a good indication on where to start, with which informants and with which topics. I started with interviews with the *vigilantes*, the caretakers of the Guadalhorce Irrigation System at Paredones, where the water gets distributed over the left bank canal and the right bank canal. From there onwards, I have been using the snowball method to select new informants. By asking every informant to indicate who he¹ collaborates with and with whom he does not collaborate (or with whom he is in a conflicting position), I could indicate with who I wanted to carry out the next interview: either with someone to elaborate on a certain topic and viewpoint, or with some one with a conflicting and complementary view.

The interviews are mainly carried out on an informal basis, and prepared in a semi-structured way (however, for officials working in Malaga city I used structured interviews, as they had a tighter schedule and couldn't be revisited that easily). All interviews are conducted in a setting which the informant has chosen himself. As such, the informant was in his most comfortable role and could speak openly about his personal concerns about the water management. In this manner, I have for example spoken to farmers at their plots, and with other farmers in the bar. With the environmental action group I had the interview in their association room, and with the representative of EMASA the drinking water company at the treatment plant. Sometimes, this resulted in an interview in which other farmers started to intervene in the conversation as well (in the pub) or it resulted in quick business talk (in the offices). In these cases, I did enjoy the new direction which the conversation took, and often this gave me new kinds of unexpected information. However, in these cases I also made a new appointment in another setting, to allow the informant to also give a personal view on the cases, and not only the view that he, as a farmer, or a office man, had to give from this specific frame. As such, most informants have been spoken to once, and others I met 2, 3 or even up to 7 times, as long as I got the impression that they kept on giving me more insights in the topic of water justice.

2.2.2 Participant observation

In addition to interviews, I have carried out participant observation. I have used two different methods for this. One method was to ask an informant after the interview if I could stay with him to join his everyday activities for a while, and the second is to choose a strategic location and stay there for a morning / afternoon and to note down all I saw. The main reason for this, is that water justice was not an easy issue to talk about for informants, and that it was sometimes easier to talk about it after I had witnessed and experienced some things as well. Especially the first method was very useful, as an informant saw that I was interested, and that I remarked issues which he bothered about as well. This often led to interesting discussions and additional information to the interview itself.

¹ As all informants, and all water users in so far spoken to, were men, I will refer to water users and informants as 'he' instead of he/she. For a further elaboration on this issue, see van der Kooij, 2009.

In addition to this, I have partly executed my fieldwork by using a bike as transport, which enabled me to fully get into the research area and do more observations than one will do by only following the main roads.

2.2.3 Flow measurements

A main issue in the Guadalhorce Watershed is the water losses due to leakages in the poorly maintained canals. As all informants gave different indications about this (some indicated that 20% of the water got lost, some indicated that only 20% arrived at the fields), I planned to carry out flow measurements in the canals. I have developed a device with a ball at a height of 0.6 times the water height attached to a floater, in order to calculate the velocity from which the discharge could be derived. I selected 3 secondary canals where I wanted to carry out these measurements (one in the head-end, one in the middle, and one at the last field to be irrigated, and a separate measurement at every point with visible leakage from the canal, for which I had brought a 10 liter bucket). These canals were selected as these were the ones where most discussion was about. However, at the first day to carry out the measurements it started to rain, and the discharge in the canals decreased. As one of the main reasons for water losses is the overtopping of canals due to bad maintenance (no cleaning), measurements with a decreased discharge would not give a valid indication anymore. Therefore, this report can not give any better indications than those (contradictory) estimations made by the informants.

2.3 Epistemology

In this research, there is no clear dividing line between the researcher and the researched. Water justice is not a theme which can be researched from an objective point of view, in which a relationship is build between the object and the subject in a 'passive, contemplative mode' as is often the norm in natural sciences (Sayer, 1992). In this water justice research, the researcher interacts with the informants and their environment, and as such already influences the situation. Also the choices of the researcher to interview certain persons and others not, make this research a personal research, which also creates my personal views.

Stating that this research is not objective is not the same as stating that this research is irrelevant. I hope that, by clarifying my own point of view, or so to say by making my subjectivity visible, this research becomes stronger, as I aim not to have any hidden assumptions in the research. In the actor network theory (Latour, 2005), people and objects are part of a network, which links them together, and which gives meaning to each other. Also a researcher is part of such a network: he/she interacts in a certain setting, and is linked to other researchers, informants and objects such as measurement devices, tape recorders, and the like.

A year before carrying out this research, I had lived for 4 months in a village in the upper part of the Rio Grande sub watershed, where I carried out a research on drip irrigation. I liked this area because of its cultural heritage and its nature. When I started the fieldwork in the Rio Guadalhorce watershed, the first thing that I noticed was that the areas differ from each other: the Rio Guadalhorce had experienced many more interventions, is polluted with waste water, and its natural flow is dammed at several places. This view, that the Rio Guadalhorce is the contrary of the Rio Grande, kept influencing my point of view in this research, and as can be read in this report, it is still the red threat in this research.

Others can have a completely different view on the differences between the Rio Grande and the Rio Guadalhorce. I spoke one informant, who was born in El Chorro. In his childhood, the electricity plant was just installed and the exciting 'camino del rey' was constructed. This path is constructed parallel to the rocks, at a height of a hundred meters, with the purpose to be able to control the state of the pipelines, which fed the electricity plant. My informant used this pathway to walk to school, which was very exciting. The camino del rey has influenced the rest of his life. He became a technical engineer, and he collected all possible information about the engineer of the dams, Benjumea y Burin. His passion for engineering is completely different from my point of view which I described above. Other persons who grew up in El Chorro, even claim that the Rio Grande is backwards, useless and unproductive.

As most people share this engineering and economy driven point of view, I do see it as important to note down the other story, which is too often overshadowed by the dominant discourse. I will describe the situation from the point of view of the farmers and the nature. Instead of focusing on Malaga, I want to focus on the rural land behind it, and show the natural richness and the cultural heritage of this area.

3. Research Background

3.1 Guadalhorce watershed

Hydrological situation

The Guadalhorce Watershed is located in Andalucia at the Mediterranean coast and drains close to the harbor of Malaga, a highly developed coastal city. The main rivers in the watershed are the Rio Guadalhorce and its tributary the Rio Grande.

Andalucia, with its Mediterranean climate and its diverse mountain ranges, has a high spatial variability in rainfall. Rainfall varies from 250 mm per year to more than 1100 mm per year (Roberts, 2002). In the Guadalhorce watershed, this variation can also be seen. The Sierra de los Nieves mountains are an area with high precipitation, the snow which falls in the winter on the mountains slowly melts and enters the calcareous bed material and gets distributed over the valley via natural springs and flows towards the Rio Guadalhorce via the Rio Grande. The downstream parts of the valley, near the sea, are relatively dry. Water sources in this area are: river water, groundwater and mainly reservoir water (see figure 1, page 3, for a schematic map of the watershed).

The Rio Guadalhorce is dammed, just like the Rio Turon and the Rio Guadalteba and these three dams form a butterfly shaped set of reservoirs. The reservoir Conde del Guadalhorce, in which the Rio Guadalhorce drains, has a capacity of 82 hm³ and the reservoir Guadalhorce-Guadalteba (in which the Rio Turon and Guadalteba drain) have a total capacity of 312 hm³ (Roberts, 2002) Those reservoirs are once constructed for energy generation and irrigation water supply and now they also provide drinking water to Malaga. In contrast to the Rio Guadalhorce, the Rio Grande has still a natural character, without large interventions. At the interjection of the Rio Grande and the Rio Guadalhorce, the drinking water company pumps up the water still left in the rivers to make sure that all water is captured, and nothing will be lost to the sea.

According to Naredo (1999, cited by Baker, 2001) there is no country with so many reservoirs as Spain (in ratio of land/reservoir). The Guadalhorce area is a typical example: it has three large reservoirs, providing water for energy generating purposes, for irrigation and for drinking water. Of these three lakes, one does not provide good-quality water, as the river upstream flows through a salt containing sediment layer.

became more and more democratic (from central-managed to Comunidades Autonomas), together with the 'economic convergence' movement of the European Union (reduction of the public deficit). As such, water management is now increasingly controlled by private companies, and economic profits are a main requirement when water allocation priorities are set. According to Bakker, 2001: "Mercantilización is thus better viewed in the Spanish context as a contested and incomplete process of resource regulation, a site of struggle in which various strategies of privatization and commercialization of water are both adapted to and opposed to the established dominance of state control over water resource allocation." (pp 783).

For agriculture this policy means that investments in irrigation only should be made when agriculture is competitive. Implicitly this causes that decisions about water allocation are increasingly focusing on economic and efficient water use.

This new water law is questioned by academics. Main arguments are that water is a unique resource which does not have the same characteristics as other tradable goods, as it is fluid, as it does not follow boundaries and it can serve several functions at one moment. As such, it can not get a simple monetary value (Bakker, 2001). Furthermore, an economy-based water distribution risks to look at short term benefits instead of the long-term benefit of the environment. Within a neoliberal view it is easy to overlook the importance of water for the environment, as the quality of the environment does not directly lead to a profit.

In 2001 the Plan Hidrológico Nacional was enacted. This policy includes additional goals of water quality improvement, water demand management, water use efficiency and environmental protection. The Spanish policy towards irrigation is expressed in the National Irrigation Plan, which includes rehabilitation plans of profitable irrigation systems. The European policy towards irrigation is captured in the Common Agrarian Policy (CAP) and mainly focuses on subsidies on agricultural products and the modernization of infrastructure with drip irrigation.

To improve integrated watershed management in a decentralized manner, the regional Agencia Andaluza del Agua (under the ministry of environment from the Junta de Andalucía) was established in 2005 to replace the role of the Confederación Hidrográfica del Sur, which was part of national government. Part of this change also includes – again- that farmers are obliged to organize themselves in WUA's. This does not include a total irrigation management transfer; the state continues as the owner of the water and the infrastructure. Just the responsibilities for operation and management are transferred. According to a students report (2006): "responsibilities of the WUA's as formulated in the National Water Law are as follows:

- take part in the watershed organization (AAA);
- Have a voice in the Comisión de Desembalses and the Comisión de Sequía;
- Get a legal status; acknowledged as official boards;
- Get the authority to allocate water, collect water fees and fine violators.
- Receive the right of use (not the ownership) and maintenance responsibilities;
- Receive the right to get technical and financial support for reparation and improvement of the system." (Bleeker et al, 2006)

The Spanish Government states the following about water users organizations:

“The water users who take water from a single intake have to constitute Water Users Associations. If the main use is irrigation, these are called Comunidades de Regantes (irrigators associations). The statutes and regulations have to be set up and approved by the members of the Confederation. The rules will regulate the organization as well as the internal system (within the spatial borders of the WUA)” (La ley de aguas, 1985, quoted in Vos, 2001)

It is interesting to note that the water users of the small scale irrigation systems along the Rio Grande have been organized in WUA's since historic times (as the farmers refer to it), and that they only had to legalize their WUA by informing the state of their existence, although many did not see the need to do so, and thus kept on managing and exploiting their irrigation sources informally. In the Guadalhorce Irrigation System however, no traditional linkages existed between irrigators which makes it hard to set up a WUA. Often, the WUA's in the Guadalhorce Irrigation System only exist on paper, which highly complicates the operation of the irrigation system. An interviewed vigilante describes the complexity as such:

‘A las acequias falta organización. Los agricultores tienen que organizarse, y necesitan aguador. Pero no lo hacen. No tienen organización, ni aguador. Pero yo no puedo dirigirme a hablar con cada uno, y después hablar con otro.. es imposible. Por ley hay que tener representantes. No hay en las acequias, entonces lo que hago, es echar agua por las acequias, y espero que ellos lo arreglan juntos. Porque no sé cuanto cada uno utiliza, no es posible de hacer una vuelta con el agua como hicimos antes, algunos días agua por este acequia, luego a otra acequia. Entonces, dentro los límites que tengo, cada día echo un parte de agua por los acequias.’

The difficult communication between the irrigators and the Junta de Andalucía does not only have impact on the distribution of the irrigation water, but also on the maintenance of the irrigation infrastructure. For example, a report of the Junta de Andalucía in 1997 describes the Guadalhorce Irrigation System (Junta de Andalucía, 1997). The aim is to describe the current state of the system, in order to point out possible improvements in the irrigation infrastructure. In the first paragraph of this report the author excuses himself for the lack of information, as he had no contact person of the irrigators to speak to.

3.3 history Guadalhorce Watershed

Just a fifty kilometers away from the rush of Malaga city lay the villages where farmers are irrigating their fields, using traditional infrastructure designed and implemented by the Arabs who conquered Andalucía in the 8th century and who left the country after almost a millennium, in 1570. These small irrigation systems are mainly found in the sub watershed of the Rio Grande, where irrigators communities make use of natural springs or intakes in the river. The water flows through acequias and in the fields local methods of furrow irrigation are practiced.

In the Rio Guadalhorce, where a modern irrigation scheme is built since 1973, several clay weirs still get constructed according to Moorish standards. Farmer groups claim the right to build these weirs in the river to increase the flow in their acequias, as the Guadalhorce

Irrigation System is not providing them with sufficient water. Farmers refer to these rights as from 'immemorial times'; these can be traced back to Arab times.

However, the Rio Guadalhorce has undergone many changes over time. The history of the Rio Guadalhorce reflects the Spanish hydraulic policies: in the beginning of the 20th century, technological optimism dominated. Dams got constructed to generate power for electricity and to irrigate barren lands. Franco, governing Spain from 1936 till 1975 highly stimulated the construction of dams, resulting in more than a thousand artificial lakes at the end of the century. In this chapter I will describe the history of the Guadalhorce watershed since the 20th century.

3.3.1 Hydraulic paradigm

In 1903, at the start of the hydraulic paradigm, the first plans were developed for a dam in the Rio Turon, a tributary of the Rio Guadalhorce. Benjumea y Burin, the engineer of this dam, had plans to use the level difference of 100 meters in the Turon river to generate electricity.

As the state would not finance a project with only economic incentives, Benjumea y Burin had to expand his project in such a way that it had public benefits as well. He proposed to irrigate a 4000 hectare in the Guadalhorce valley, which would lead to the development of the agricultural situation of the inlands. He constructed this dam in 1921, and the dam got named after the engineers' nickname Count of Guadalhorce: 'Embalse del Conde de Guadalhorce', which can stock a 76 million m³. In 1926, he extended his plan by constructing a dam in the Guadalhorce river near El Chorro, to create another electricity central, called El Gaitanejo. Furthermore, this dam would protect Malaga city from severe flooding in periods with high rainfall, and the increased irrigation potential would prevent the rural zones from getting depopulated.

Water supply for Malaga city was never included in the plans of Benjumea y Burin. In his time, Malaga was relatively small and some natural springs near Torremolinos provided enough water for the city's needs.

However, Malaga started to grow from 1920 onwards. Especially in the 1960s when Franco approved the tourist industry, Malaga's population growth accelerated. Not only the number of inhabitants of Malaga was growing. Also the amount of water used per inhabitant started to grow: more and more people construct swimming pools in their gardens and water using tourist attractions such as golf courses became more and more popular.

In the beginning of the 60s, plans came up to elaborate the irrigation system of the Rio Guadalhorce. One of the reasons for this was to provide the sugarcane industry near Malaga with sufficient irrigation water. In the first design, it was planned to irrigate a 21.621 hectares (Junta de Andalucia, 1997) in the valley of the Guadalhorce river. By including electricity centrals, the plan was made economically viable. However, the growing water demand of Malaga changed this plan. It became clear that Malaga's growth implied a search for new drinking water sources. The spring of Torremolinos, a city which boomed even more than Malaga because of tourist industry, was not at all enough. Therefore, a 47.5 million m³ per year got assigned for drinking water of Malaga Capital, diminishing the irrigation potential. The execution of this irrigation project fell under the law 'Ley de Colonización y

Distribución de la Propiedad en las Zonas Regables' from 1949. This law enabled large landowners to profit from the redistribution of lands. A critical farmer in the Guadalhorce Irrigation System calls the construction of those two reservoirs and the irrigation infrastructure 'our last heritage of Franco' referring to his top-down technology driven interventions.

The final design, which aimed at irrigating a 19.000 hectares, was based on two reservoirs in the Rio Guadalhorce and the Rio Guadalteba, together having a capacity of 300 million m³. The system was designed on top of the former irrigation infrastructure making use of the original canal layout. From the El Chorro reservoir towards Paredones, just above the village Alora, the water would flow through a main canal, with some offtakes towards the irrigated areas. At Paredones the water would be diverted in two channels: the right bank and the left bank. The height difference is used for an energy plant. The left bank canal is both used for irrigation and for water supply to Malaga.

During the construction phase, Spain got into hard economic times, and the disproportionate plan seemed to be impossible to implement completely: only a 13.000 hectares got transformed. Taking into account the state of the infrastructure and the thin soil layer at some locations, 9000 hectares (of which 5380 hectares had already access to water from former irrigation infrastructure) are currently in use, and a canal towards Malaga provides the Malagueños with drinking water.

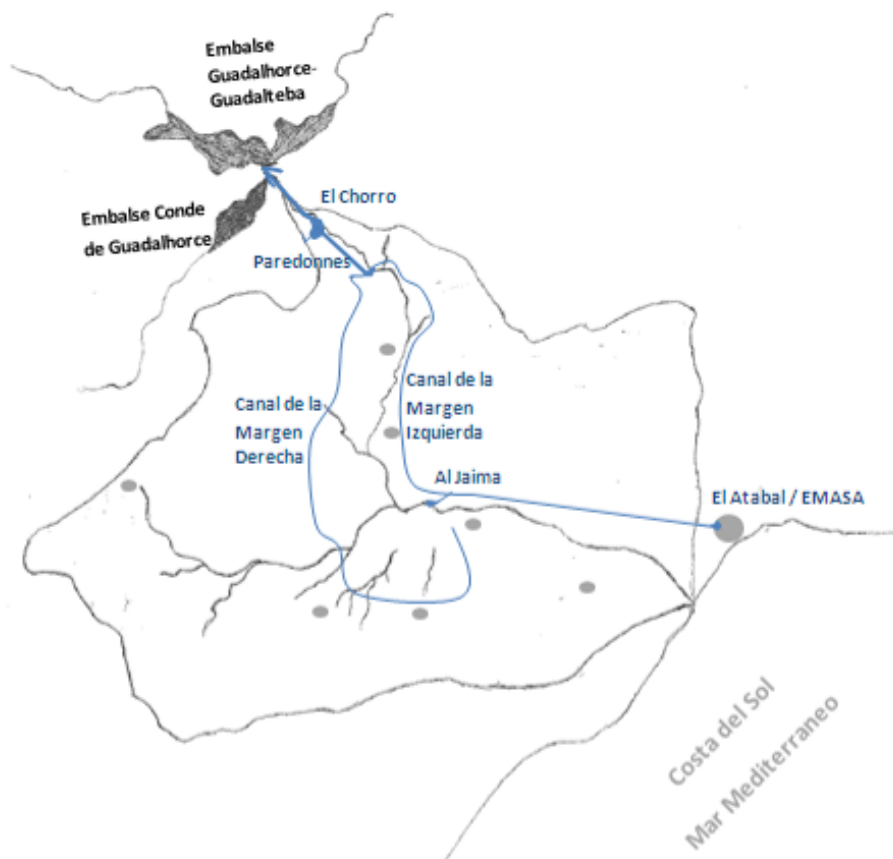


Figure 4, schematic map of the irrigation infrastructure.

The drinking water company of Malaga, EMASA, has been constantly improving and diversifying its technologies. Malaga's need for water grew. In 2003, EMASA has constructed

inlets from the Guadalhorce river and pumps in the Guadalhorce aquifer Al Jaima, and EMASA started using a desalinization plant.

While EMASA innovated in order to catch up with the cities water demand, the irrigation system formerly managed by the Confederación Hidrográfica, now managed by the Andalusian government, did not change at all. The irrigation infrastructure turned out to be constructed on clayey soils which made the canals break easily. In addition, the changes in design which were made during the execution of the project made the canals become over-dimensioned. Within a couple of years, the new irrigation infrastructure started to leak, which made irrigators have no confidence in the Confederación Hidrográfica. The intention of the Confederación Hidrográfica del Sur was to form water users organizations, which would manage the operation and maintenance of the irrigation system at secondary level, as stated in the water policy of the Confederaciones Hidrográficas.

The farmers, who saw the poorly designed canals, noticed that being responsible for the maintenance of this system would imply troubles and they feared to bear the costs. Many of them refused to form water users associations. This led to a situation in which the Confederación Hidrográfica only repaired essential parts, and in which irrigators had to deal with a small quantity of water arriving at their fields – the rest is lost due to leakages which are especially high in the secondary canals, as for these, no-one (neither the Confederación Hidrográfica, neither the irrigators themselves) has taken up the responsibility. In the worst case, losses up to 90% are mentioned by irrigators (Junta de Andalucía, 1997).

When decentralization of the Spanish government started in 2003 (which, in practice, resulted in a new institutional setting in 2009) according to an interviewed vigilante, the maintenance of the irrigation system did not improve. The Junta de Andalucía, which took over the responsibilities of the Confederación Hidrográfica had the same problem as the Confederación Hidrográfica: it is difficult to manage an irrigation system when the farmers do not form associations, they had no contact person to communicate with. According to some farmers, it might even have become worse, and also another vigilante mentions:

- *Había la descentralización, verdad?*
'Hay mas burocracia. Es mas cerca, pero no es mas efectivo.'

- *porque es eso?*
'Nunca lo han hecho antes: tenían que comenzar todo de nuevo, y en la Confederación Hidrográfica si habían expertos con experiencia. Todos los organismos tenían que aprender de trabajar juntos en nuevas condiciones, hay tanto a aprender.'

'Y además, estamos en transición. Antes había la Confederación Hidrográfica, lo que es la Junta Andalucía en este momento. Es difícil – la Junta Andalucía es nueva, son nueva gente, y no conocen tanto lo que estamos haciendo. No tienen la experiencia, la practica... no entienden el campo...'

As this quote shows, the newly assigned AAA officials have quite some troubles with understanding the Guadalhorce Irrigation System management. Only recently, irrigators started to react more positively on the institutional changes. This is mainly due to the involvement of the European Union, which provides funds for irrigation modernization projects.

3.5 Actual Situation

At this moment, two issues concern the farmers in this region: the low prices for their produce, and the water shortage in the valley.

The small scale irrigation schemes in the hills surrounding the Guadalhorce Irrigation Scheme are even more affected by the low citrus prices as their plots are smaller and as such difficult to reach with mechanical tools. But they did have some advantages: they had no direct competition with Malaga over surface water resources (but sooner or later, influence of abstraction of groundwater will also become visible to them), and they had a long experience of organizing themselves, which has a positive effect on the maintenance of their infrastructure but also on their possibility to gain financial support from the government and the European Union. The large-scale Guadalhorce Irrigation System farmers have more difficulties with organizing. The water users within one sector are not necessarily from the same village, neither do they have the same agricultural interests: some of them cultivate their fields as a 'pasatiempo', as a distraction from the office work they do, or they are retired, and have no more interest than cultivating some fruits for home consumption. Others, however, are 'entrepreneurs' with more land, and according to their neighbors, they are not real hands-on farmers, they are businessman working with papers and subsidies. The last group of landowners in the Guadalhorce Irrigation Scheme are the giri's, foreigners who buy country houses, and who do not have a direct link with farming. An elaborated actor description follows in chapter 4, but this brief explanation already indicates: the diversity of the Guadalhorce Irrigation Scheme farmers is high, and their interests differ, so they do not easily form water users associations, which in the small scale irrigation schemes uphill seems so easily managed – as they often already existed, under a different name. Those Water Users Associations are necessary in order to gain support from the Spanish government, for example to modernize irrigation systems with drip irrigation infrastructure, a trend which is especially going on in the small-scale irrigation systems, and in one of the areas of the Guadalhorce Irrigation System.

In the Guadalhorce Irrigation System, farmers rather install individual drip irrigation infrastructure, others bore tube wells to ensure a certain water supply.

Year	Water released for irrigation (hm ³)	Irrigation water availability (m ³ /hectare/year)*	Irrigation water availability (mm/year)*
2006	3.80	253	25.3
2007	14.23	949	94.9
2008	12.31	821	82.1
2009	29.63	1975	197.6

* including an irrigation efficiency of 60%.

All data for this calculation collected at Paradonnes, at the vigilantes office.

According to Roberts, 2002, agriculture in the Guadalhorce catchment gets 50-60 hm³ per year from the reservoirs, and 47hm³ per year is released for domestic and commercial consumers. These 50-60 hm³ per year are divided over a 9000 hectares which are actually under irrigation (Junta de Andalucía, 2008). As a point of departure, the Confederacion Hidrografica has as a reference an irrigation gift of 6996 m³/ha/yr (Plan Hidrologico de la

Cuenca Sur, quoted in Junta de Andalucía, 1997), which is similar to the actual needs of an average citrus plot which requires 6880 m³/ha/yr (Junta de Andalucía, 1997).

In the current dry years however, farmers got 1-2 emergency turns per year. In 2006, an extremely dry year, nearly 4 hm³ was released for agriculture, while the drinking water company did not have to do any concessions. The 3.8 hm³ released for irrigation in 2006 results in an irrigation water availability of 253 m³ per hectare per year (an irrigation efficiency of 60% is included in the calculation), which is only 3,6 percent of the reference given by the Confederación Hidrográfica.

Even in 2009, which is considered by farmers as a year with sufficient rainfall and enough water in the reservoirs, agriculture got only a 30 hm³ for irrigation. In practice those 30 hm³ seemed to be sufficient, as in the last year it appeared that more farmers than expected had stopped irrigating their lands. This is expressed clearly by a vigilante (Juan Francisco Marin):

Este año, sabes, pasa algo muy raro, que no hemos previsto. Lo que pasa, este año, si hay suficiente agua. Nosotros, los vigilantes, abrimos las tomas por las acequias secundarias, pero nos quedamos con agua! Los regantes no lo utilizan! Si, lo utilizan, pero no tanto como normal. Hay regantes que no quieren regar.

- *Entonces, porque es eso? Como puede ser? ...Tienen pozo?*

Algunos si. Otros abandonan sus campos, y no quieren regar. No quieren mas.

Lo que pasa, en este zona... es complejo, no hay solamente un problema, hay varias. Las frutas no se venden. El precio de las frutas es muy mala – pues estos días son bastante bien. Cuando en Murcia y Valencia la cosecha es malo, vienen por aquí para comprar las frutas. Eso esta pasando ahora con los limones. Entonces, este zona depende de Murcia. El mal precio de cítrico, conjunto con los años de sequía - que fue la gota.

La agricultura.. lo hacen como tradición. Los pueblos.. por eso creo que los pueblos admiten tantas urbanizaciones: las urbanizaciones financian el pueblo, las urbanizaciones son la mayor entrada de dinero.

4. Water Use Actors

As can be concluded from the previous chapter, different stakeholders in the Guadalhorce watershed put a claim on the scarce water. The main groups can roughly be divided in the sectors agriculture, drinking water sector, industry, recreation and nature. These sectors have different formalized rights to water, according to the priorities in the Spanish water law. In practice, it is highly complicated for some of these sectors to gain (or maintain) access to water with a sufficient quality, and conflicts between these sectors arise.

Also in sectors, differences in water access and rights exist, which will be described within this chapter. The conflicts which arise from the inequalities between different water users (inter- and intra- sector conflicts) will be described in chapter 5 by using case studies.

4.1. Irrigators (agriculture)

Agriculture uses a large share of the available water resources in the watershed. The Guadalhorce Irrigation System consumes 2200 m³ per day in high season (Junta de Andalucía, 2008), and small scale irrigation systems are not registered but, according to surface, would approximately be a similar amount of water, as the total surface is slightly smaller but these irrigation systems on average use more water per irrigated hectare as they

are less influenced by shortages. Both in small-scale irrigation systems and in the Guadalhorce Irrigation Systems, average farm sizes are between 3 and 5 hectares, with some exceptions of large scale entrepreneurial farmers with up to 80 hectares.

4.1.1 Guadalhorce Irrigation System and small scale irrigation systems

The difference between the small scale irrigation systems in the sub-watershed of the Rio Grande and the Guadalhorce Irrigation System are large. The main difference is that the small scale irrigation systems have a much longer history, which can be seen in their practices such as collective maintenance of the Irrigation infrastructure and traditional water distribution patterns. This results in several differences in their current position:

State (in)dependency

Because these small scale irrigation systems are small and date back from 'immemorial times', the state hardly intervenes in these. Actually, the management of the AAA does not even have a map in which all these small scale irrigation systems are indicated, thus some are not even officially legalized. The small scale irrigation systems in the Rio Grande have their own management, and form water users organizations. Some of these water users organizations have declared their water users organization to the AAA, which makes them formal, which gives them official right to use their water source and it gives them access to funds.

The Guadalhorce Irrigation System however is constructed by the state, which still has a large impact on the management of the irrigation system. Water users have hardly organized themselves in water users organizations, and as such, have no official way to intervene in the management of the Guadalhorce Irrigation System. Only recently, water users start to organize themselves in order to get funds for modernization projects from the EU.

Another particularity of the Guadalhorce Irrigation System is that it is intertwined with the drinking water infrastructure, which is a limitation for them as a status quo has to be reached in terms of water quantity as well as quality. As such, it could be concluded that irrigators of the Guadalhorce Irrigation System are dependent on the State, while the small scale irrigation systems are quite independent.

Water quality

The water quality of the irrigation systems differs enormously. In the Guadalhorce Irrigation System, water has a high salt content which makes it impossible for farmers to cultivate cash crops such as avocado. Some of the small scale irrigation systems use clear water from natural springs, which is of drinking water quality. Other small scale irrigation systems, more downstream at the Rio Grande, use polluted water as the river gets mixed with waste water from the city Coin.

4.1.2 A wide variety: from entrepreneurs to recreational farming

Also within the irrigation systems many differences can be found, especially between the motivation of irrigators to farm, and their relation to land. To describe these different types of irrigators, I will make use of the subdivision made by Vos 2001, with some added categories and additional information based on field research results of 2009. Vos has made

the subdivision for the Guadalhorce Irrigation System irrigators, but this is valid for the small scale irrigation systems in the Rio Grande sub watershed as well.

Jornaleros

Jornaleros are laborers which can be hired on a daily basis by landholders. The jornaleros are skilled in irrigation practices (mainly in furrow irrigation methods) and are only hired on the moment that the landholder needs them. When, in times of scarcity, a landholder does not get his irrigation turn, he will not hire a jornalero. Another moment in which jornaleros are hired, is when fruits need to be picked. As citrus prices are low, quite some farmers decide not to hire jornaleros as their labor prices are higher than the price for which he can sell his produce. As such, there is few demand for jornaleros, and some jornaleros start practicing other jobs such as construction work in the coastal area.

The access to water for jornaleros is mediated by landholders who are entitled to water rights, the jornalero has no say in this. Neither can a jornalero participate in water users organizations – or they should have a plot of their own as well.

To conclude, jornaleros' work highly depends on water availability, but they do not have the possibility to influence water distribution.

Encargados

An encargado is in charge of the activities on the landholding. Most often, the owner of the landholding is not living in the area, and comes by once in a while. As such, the encargado makes decisions on the farm, for example about the time to irrigate, or the moment to plant certain crops. The owner of the landholding does make the main decisions, such as irrigation methods to apply, or which crops to cultivate.

The encargado of the farm has good contact with the aguador, if there is one at his irrigation sector, and makes the arrangements for irrigation scheduling. Although he is not the owner of the plot, he is accepted by the aguador, vigilantes and neighboring irrigators as the decision maker. This also gives him the possibility to participate in water users organizations, and to vote for decisions.

In some cases, the encargado of the farm gets a certain share of the produce, which makes him have a stake in the well being of the farm, and which is also a strategy of the landholder to share risks (Vos, 2001).

The encargado thus does not own a plot for himself, but does aim at maximal production and care for the landholding, for which he needs sufficient water. He has access to irrigation water – although limited in drought years, especially for the ones in the Guadalhorce Irrigation System, and if a water users organization is present in his area, he is able to make decisions.

Type of irrigator	Characteristics	Access and rights to water
<i>Jornaleros</i>	<ul style="list-style-type: none"> - can be hired per day by larger landholders (with at least >3 hectares) - tasks: irrigating and fruit picking - no long term contract 	<ul style="list-style-type: none"> - only access and rights via entitled landholders - no participation in WUA's - Irregular access to water from GUADALHORCE IRRIGATION SYSTEM (limited in drought years)
<i>Encargados</i>	<ul style="list-style-type: none"> - are hired by landholders for a longer period - are responsible for the management of the landholding - owner is often not present 	<ul style="list-style-type: none"> - rights to water on the name of landholder - direct access to water - Access to water from GUADALHORCE IRRIGATION SYSTEM limited in drought years - can participate WUA's
Entrepreneurial farmers	<ul style="list-style-type: none"> - in small scale irrigation systems: produce organic vegetables and fruits, or tropical fruits such as avocado - in GUADALHORCE IRRIGATION SYSTEM: own a large landholding (>60 hectares) - Aim at a high production - hire an encargado and/or jornaleros - willing to innovate and search for new options 	<ul style="list-style-type: none"> - have official water rights - possess own (legal or illegal) well for times of water scarcity in the irrigation system - can participate in WUA, his participation depends on strategic choices
Full-time non-commercial farmers	<ul style="list-style-type: none"> - on average aged >50 years old - inherited family plots - strong emotional relation to the land - do not have many ties outside the community 	<ul style="list-style-type: none"> - have official water rights - Irregular access to water from GUADALHORCE IRRIGATION SYSTEM (limited in drought years) - can become WUA member, but often reluctant to participate in WUA's in the GUADALHORCE IRRIGATION SYSTEM. In small scale irrigation systems often participating in WUA's.
Part-time farmers	<ul style="list-style-type: none"> - income comes from (part-time) job - attempts to make profit from agriculture - make investments in irrigation technologies - outwards oriented, with ties in other businesses 	<ul style="list-style-type: none"> - Have official water rights - Irregular access to water from GUADALHORCE IRRIGATION SYSTEM (limited in drought years) - Often possess a private well (registered or illegal) - Can become WUA member, are often willing to do so, have a stake in decision making within the WUA.
<i>Domingueros</i>	<ul style="list-style-type: none"> - 'Sunday' farmers, visiting the landholding only in the weekends - Production for home consumption - Often with swimming pool - Relaxation is more important than production - Relatively small land holdings (<1 hectare) 	<ul style="list-style-type: none"> - have official water rights - Irregular access to water from GUADALHORCE IRRIGATION SYSTEM (limited in drought years) - Request water access in the weekends (request is most often honored) - Often possess a private well (registered or illegal) - Can become WUA member, are often not willing to do so because of time constrains and individual mindset.
<i>Giris</i>	<ul style="list-style-type: none"> - Foreigners (German, British) holding land in the countryside - Have limited knowledge on agriculture, irrigation and water distribution - Have limited contact with other irrigators 	<ul style="list-style-type: none"> - are often not aware of water rights and obligations - access water (from GUADALHORCE IRRIGATION SYSTEM or from private wells), often without knowing whether they are allowed to use it - can not participate in WUA's because of language gap and are often not invited

Entrepreneurial farmers

According to a farmer which could be classified as a 'entrepreneurial farmer', farmers with entrepreneurial motivation in the Guadalhorce Irrigation System can be counted on two hands. In the small scale irrigation systems more entrepreneurial farmers seem to exist, but neither do they form a large group. Entrepreneurial farmers are the farmers that have to motivation to make an enterprise from their landholding, they search for good market opportunities and which make profit out of agriculture. The entrepreneurial farmers in the Guadalhorce Irrigation System are in a slightly unfavorable situation as the irrigation water from the Guadalhorce Irrigation System contains a high salt character, and access to it is unreliable. Therefore it is hard to change from citrus to more profitable crops such as avocado, which has a low salt tolerance and a high water demand. For farmers in the Guadalhorce Irrigation System, the only way to produce profitably is to use the advantage of scale, and to have large landholdings. For example, an owner of a landholding near Pizara with 80 hectares indicates to make sufficient profit to live from.

At the same time, a landholding in a small scale irrigation system in the Rio Grande area can already be profitable with 7 hectares, as a farmer in Coin indicates. He has the advantage that the water is of high quality, and that the climate is softer. Therefore, he can produce avocado's and several organic vegetables.

Often, an entrepreneurial farmer hires jornaleros or an encargado to help on the land. He also invests in irrigation technologies, for example drip irrigation and fertigation.

Furthermore, if their access to water from the main irrigation system is not sufficient, an entrepreneurial farmer tries to search for alternative sources such as a private well or even tube wells to ensure a good harvest. As most decisions on the landholding are made on the basis of a profit calculation, he also makes a strategic choice for joining a water users organization. Some, as an entrepreneurial farmer in between Cartama and Malaga for example, set up a water users organization to enable themselves to claim against the high prices they have to pay for the irrigation water from Guadalhorce Irrigation System, and another entrepreneurial farmer near Coin was a main force behind the modernization of the small scale irrigation system into drip irrigation. Others, such as the above mentioned entrepreneurial farm in Pizara, managed by an encargado, have chosen to act individually as they are large enough to exercise power on the water management.

Full-time non-commercial farmers

Full-time farmers are farmers who's main occupation is the work on the land, but without having high profit aims. They have no side-activities which gives them an income, and stay the whole day at their plots to irrigate, to harvest, to process their fruits (for example into wine), to take care of animals at their plots (rabbits, dogs, goats) and to chat with other farmers. The average age of these farmers is above 50 years old and they have inherited family plots. As it is their daily occupation, these farmers have a strong emotional relation with their plots, and some would even invest more in their land then the return which they get from it. The investments which they make are mainly made to make the landholding more attractive for his family (especially children and grand children) and thus invest in small country houses with guest rooms, swimming pools, and pets. On average, these farmers do not have many ties outside their community.

These irrigators mainly use conventional irrigation methods (furrow irrigation) and they do have official rights to irrigation water. It might be that their water rights are still in the name

of their ancestors. They have access to irrigation water, but in water scarce periods their access to water is limited. In the small scale irrigation systems they are often willing to join water users organizations as they have sufficient time to be present at meetings. In the Guadalhorce Irrigation System, these farmers have good knowledge of the history of the irrigation system, and do not trust the Confederacion Hidrografica (which is now the AAA, but these farmers still use the name of the old water management institute). As such, full time non-commercial farmers in the Guadalhorce Irrigation System are reluctant to organize themselves in water users organizations as they do not want to become responsible for the deteriorated infrastructure.

Domingueros

Domingueros are, as the name indicates, mostly present on their plots on Sundays. They have a job in one of the villages or rather in the cities of Malaga, Marbella or Benidorm, and come to the country side to relax. As their main objective is relaxation, they do not want to bother too much about farming and the irrigation system. They do cultivate their plots – but mainly with the objective to consume their produce within their own household. They often bring their relatives with them to the land holding, and like the full time non-commercial farmers they have invested in recreational assets at their plots.

A complicated factor from being present only in the weekend, is that their irrigation turn should fall within the weekend as well. As can be imagined, this creates troubles for the irrigation schedule of a secondary canal. Most often, this is solved by letting the entrepreneurial and full time farmers irrigate during the week, and the domingueros can irrigate in the weekends. Other solutions are for example to use the swimming pool as a reservoir, let someone fill this during the week, and use the water for irrigation (by using drip irrigation) on Sunday afternoon, after swimming in it.

Other water users are gossiping about Domingueros and blame them for making the irrigation schedule difficult, and for not caring enough for the area. Neither do they participate enough in water users organizations, as meetings are often scheduled during the week. They themselves have an awaiting attitude, and rather wait for the state to repair the infrastructure than to take action. An entrepreneurial farmer (federacion de regantes) had set up a street protest in Malaga to claim that they pay too high fees for irrigation water, which was hardly visited by peer-irrigators. He explains how the other irrigators are doctors or lawyers by profession, which makes them hesitant to block roads in Malaga with tractors, as it is not their class. Furthermore he argues that these persons have enough money to spend, so they do not care much for sufficient irrigation water to make their crops profitable. One of the vigilantes even explains how some of these domingueros do not even know how to irrigate:

‘ Te contaré una historia. Hacia algunas días, un señor me llamó. Es el dueño de una finca, el es de Málaga. Me llamó para preguntar: cómo puedo regar? Cómo puedo obtener mi turno de riego? Y yo le explico que echaré agua por la acequia, y que ellos mismos tienen que hacer la distribución. Entonces me preguntó: por lo menos, puedes indicarme de dónde tomo agua? Entonces no sabía dónde era el canal secundario! Yo le visité, y fuimos juntos al canal. Encontramos la acequia principal, y me dijo: ah, lo veo, ahí está! jeje, cómo puede ser. No entendió que no se puede tomar agua del principal. Es muy triste, pero es muy típico de aquí.’

Giris

Although domingueros are gossiped about, they are not the group which is most blamed. The giris are the ones about which most jokes are made. "Giri" comes from "girasol", sunflower, which turns its head in the direction of the sun, exactly what foreigners from Northern European countries are perceived to do. These foreigners came to enjoy the sun and the Mediterranean climate, and bought holiday homes in the countryside. For them, irrigation is an exotic practice, and they do not exactly know what to do with it. Some giris like the irrigation practices, and fully explore the possibilities and see it as a hobby, but due to the language barrier they do not completely understand the rules in use. This results in situations in which they use the irrigation turn which was meant for a neighbor, or in illegal use of wells. Others have no clue about irrigation, and do not use irrigation water. Their plots with citrus dry out, and the soil gets crusted. Local people perceive this as the worst thing one can do. Furthermore, they often do not pay their water bills, which results in being taken away their water rights, which is irreversible. Due to language barriers, they do not participate in water users organizations or informal discussions on the water management.

4.2. EMASA (drinking water sector)

Within the Spanish water law, the drinking sector is the first priority in the allocation of water. Drinking water is seen as a vital good for society, to which every person should have access. Therefore, the drinking water companies are in the favorable situation that they do not have to compete with other water users over their water rights. In practice, competition with other water users exists, for example in the situation of Alhaurin el Torre, where the company AquaLauro is the drinking water provider which uses groundwater, competition over the exploitation of the Mijas area is clear: they have to construct deeper tube wells as also golf courses are pumping up water from the same depth.

In the Guadalhorce Watershed, EMASA is the largest drinking water company, and some smaller drinking water companies exist for the urbanizations and villages in the inlands. 100% of the drinking water used to come from the Conde de Guadalhorce reservoir, but a flooding in 1989 changed the strategy of EMASA. EMASA decided to diversify its water sources to ensure that the population would have clean water at all times. As such, they now use water from the reservoirs, from underground sources and two new lakes at the north east of the watershed.

A main concern in the search for new water sources are the energy costs. Energy costs to pump up water from deep tube wells are high, but also the treatment of polluted surface water costs a lot of energy. EMASA for example uses a desalinization plant to purify the water from the salt Guadalteba lake. Filtering the salt water by pressing it through membranes causes a high energy consumption. However, EMASA still manages to keep the water fees relatively low, at least lower than the coastal cities around Malaga. AquaLauro constructs deeper tube wells to fulfill the growing demand. Plans of EMASA are to construct a dam in the Rio Grande. More about this in the cases chapter.

Both drinking water companies are innovating actively, and they search for new methods to abstract more water, but also to save water within the network, or even to lower the water consumption of the costumers. For example, EMASA has installed water meters at every household, which makes the water consumption visible for inhabitants, which leads to a reduction in their water use. Furthermore, these water meters enable EMASA to find leakages in their network.

In the dry period of the last five years, EMASA has send a flyer to all its costumers to ask them for using the water prudently. The year after sending the flyer, indeed an average water saving was possible. A representative from EMASA points out that it sounds strange for a private company to stimulate people to consume less, however they also notice the water scarcity in the area, and have to be prudent (in terms of relation with other users, but also in terms of future water availability).

As such, the drinking water companies legitimize their water use: first of all, they are a priority, and secondly, they even try to save water by innovating.

Irrigators completely agree with the ideology that drinking water has priority over agriculture. Their difficulty is that the water purified by EMASA is not only used for drinking water purposes, but also for gardening, washing cars, filling up swimming pools and the like, which they see as a last priority. All these uses come together under the umbrella 'domestic use', but only a very small part of this is for personal consumption or hygiene, the majority of the water is used for luxurious purposes. It should be noted that farmers do not exactly know what happens with the water from the left bank canal, which flows to Malaga. Some say that it is used for golf courses and aqua parks as well, and a commonly made comment is that EMASA is irrigating lawns in the city with clean water as well. EMASA clarifies that EMASA indeed waters lawns in Malaga, but that they use treated waste water instead. Furthermore, farmers blame EMASA of giving the clean water to tourism. According to EMASA, tourists are not their main water consumers. This can be checked, as water demand does not get higher in the summer holiday months: only at the yearly *feria* a higher water demand gets noticed. According to EMASA, this is due to the fact that EMASA also provides water to the university campus, which is closed in the summer. As such, water use of the campus could be equally high as water use of the tourist sector.

4.3 ENDESA (industry)

ENDESA is the energy company. The energy sector was the first to initiate the construction of the dam in the Rio Grande, and the energy plant in El Chorro (see figure 3) got a concession without a certain time limit for a fixed water level in El Chorro.

Currently, it would not be possible to have such an unlimited concession, as one never knows the water availability in the future. Furthermore, the industry sector has no first priority over water, according to law drinking water and agriculture should get their share first. However, the concession of the El Chorro dam can not be changed, and the vigilantes make sure that the water level in El Chorro is fixed at a specific water height needed for the energy production. This causes frictions, as it is not easy to ensure a fixed amount, especially with the old, deteriorated infrastructure of the Guadalhorce Irrigation System. For example, the Avio gates, which should function automatically, are adjusted by the vigilantes to ensure the right quantity of water. However, it happens that the water release at the dams, the

water demand of the irrigators and the demand of Malaga city are not completely in line, and that the water level in El Chorro changes.

The location of El Chorro limits the other water users, especially EMASA, from structural changes in the infrastructure. The concession for a fixed amount of water at El Chorro implies that the water from the three lakes should all pass this lake, otherwise it will not be enough. Pipelines or bypasses with the clean water from the Conde de Guadalhorce dam are too complicated to construct, although investigations are done on the possibilities, no action is taken yet.

4.4 golf courses (recreation)

In the Guadalhorce watershed, different styles of recreation related to water are possible. One could go to the reservoirs to swim, bath and camp. People from the surrounding villages come here for a relaxed afternoon. The dam Conde de Guadalhorce is also a beautiful dam to visit because of its cultural heritage. Here, one will not encounter many foreign tourists, one mainly hears the Andalucía accent from the inlands.

Another completely different type of recreation, is possible near the cities at the coast, and consumes much more water. It's the coastal area where aqua parks and golf courses are constructed to attract foreign visitors. Here, one does not meet anyone with a rural accent, the main language spoken is English. At the golf course near Alhaurin el Torre for example, the list with top-players from the last championship does not contain any Spanish name.

Golf courses are often blamed by farmers for their water use, and also in newspapers their water use gets discussed. The Junta de Andalucía has also put a stop on permits for new golf courses in the water scarce period. According to the owner of the golf course 'Lauro Golf' however, they aren't using exaggerated amounts of water: his playing fields are on a terrain where the former owner had avocado trees, for which he needed more water than Lauro Golf needs for his golf lawns. When comparing Kc values (which indicate relative evapotranspiration of the plants) from grasses (around 1.0) and avocados (around 0.6/0.7), avocados need less water, although it could be assumed that the avocado farms use the water less efficiently. The golf courses often have enough economic means to have deep tube wells, to place sprinkler installations, and also innovate with re- using waste water, as this is a requirement of the Junta de Andalucía.

According to Lauro Golf, their water use is legitimate, as he provides much more persons with an income. He goes on with the comparison between avocados and golf: the avocado farm hired one encargado, and some jornaleros for the picking of the fruits, only during the period of harvesting. He, however, has 20 persons working daily on the golf course. As such, he is much more beneficial for the economic prosperity of the area.

Farmers do not only complain about the water use of the golf courses because it would be so huge, but also because it is a very visible water use, seemingly without any limitations. When all the fields are yellow because of water stress, a green golf field is even better visible. Also, golf courses tend to have some ponds, which are both for decorative purposes as for a reservoir, to be sure that even with an energy breakdown, they still have enough water. These ponds – often with fountains – make farmers furious. In similar vein, farmers in the area perceive that agricultural water should be for food production, rather than 'luxurious'

recreation. Also, the public irrigation systems are largely subsidized by the Spanish state, thus by the Spanish tax payers, while revenues from the recreational sectors flow in the pockets of the few, who are often not from the region.

4.5 Environment

“La Junta de Andalucía tiene un ley de aguas que ni Europa, ni España puede cambiar. No existe uso medio-ambiental...pues si, el gobierno de España tiene un ley sobre un caudal ecológico. Como te he dicho, hay los usos de prioridad, entonces en caso de estrés, no queda caudal ecológica. Es por la razón que te explique, una ley del gobierno de España no es lo mas importante, es la Junta de Andalucía que decide. Hay una zona donde si existe un caudal ecológico, es en el parque nacional Tablas de Daimiel. Eso es un parque natural, entonces es por eso que si hay un porcentaje por la naturaleza. Es el único lugar donde existe eso – en mi opinión.” (vigilante in the Guadalhorce Irrigation System)

Water for the environment has not a strong legal position. Within the European framework, conditions are set which determine that ecological flows should be maintained. In the Spanish and Andalusian water law, environment is also included as a water user, but all other uses have priority over environmental flows, and as such, there is no water left for the environment.

Within the Guadalhorce Watershed, two environmental groups are active. One is the national organization Ecologistas en Acción, they are based in Malaga. According to their own description on their website, their philosophy is:

‘...(Ecologistas en Acción) Forma parte del llamado ecologismo social, que entiende que los problemas medioambientales tienen su origen en un modelo de producción y consumo cada vez más globalizado, del que derivan también otros problemas sociales, y que hay que transformar si se quiere evitar la crisis ecológica.’

Interviewed water users in the area consider this vision of Ecologistas en Acción too radical, they have little support from the area. At a national scale Ecologistas en Acción seem to be better known than at the level of the watershed. The other group who fights for the environment is Association Jara. This dynamic environmental group, together with the Coordinadora en Defensa del Rio Grande, finds more support at the local level. Their organization is not only focused on the environment, but rather on the whole countryside, including the traditional *huertas*.

5. Case studies

The Guadalhorce watershed is an area of constant struggle: Three lakes provide this area of water, but one of these lakes has a high salt content. The two others have not been completely full last years because of a shortage of rain. Every year, a commission of water users comes together to distribute the water in equal shares, but not all members have an equal voice and not all decisions are also carried out in practice, as especially can be seen in the promise of keeping apart a certain minimum discharge in the river Guadalhorce for nature purposes. This river is completely dried up before it reaches the sea. Different parties of water users have protested against the unequal distribution. Farmers of the irrigated perimeter have organized protest in Malaga city and inhabitants of Coín have started a project 'Rio Grande vivo' to claim water for nature. Besides these protests, technical solutions (micro-irrigation, re-using waste water) are searched for to save water for other users. But water users show how this is not only a matter of getting the technologies right: agitated farmers blame foreign water users of the scarcity and complain that golf courses can use water without getting the right permission. The discussions seem to reflect a much wider problem in the society: that of conflicting cultures, which are reflected in water use as there problems center. Thus, next to getting the technologies right, it is also about institutional issues, about understanding cultures and living together with scarce resources. Therefore, a broad scope is needed to understand current processes of water cultures in the Guadalhorce watershed, in which technology, history and sociology play a central role.

The water demands of all actors exceed the amount of water available in the watershed. In the period of executing this research, summer 2009, the reservoirs in the North of the watershed are only half full, which is an improvement compared to 2008, when the lakes were, in high summer, at 20% of their capacity. Many of the interviewed indicate that water scarcity in this region comes in cycles. The last five years were water scarce, and the interviewed state that the next years will thus become better. The last five years different actors have developed their strategies to overcome the water scarcity and to defend their water rights.

EMASA, the drinking water company of Malaga that has a priority by law over the water use, has constructed a desalinization plant, which enables them to use the salt water in the Guadalhorce reservoir. This made water prices for their clients higher, which led to a lower water consumption per inhabitant (also caused by campaigns to stimulate Malagenos to use less water). Other sectors had more difficulties to overcome the water scarce period. Farmers in the Guadalhorce watershed could hardly enforce their water rights, as drinking water has a legal priority, they only managed to get a small share of the water in the reservoirs (in 2007 and 2008, they were allowed to irrigate only twice), which was just enough to keep their citrus trees alive – but it was not enough to produce fruits. Some farmers found individual solutions, such as installing (legal or illegal) pumps or using waste water from the smaller cities, which do not have a treatment plant. Other farmers simply sold, or abandoned, their lands.

Farmers in the small scale irrigation systems in the Rio Grande sub watershed, often making use of natural springs or shallow tube wells, encountered water scarcity problems, especially those who are located down in the valley, near other groundwater users. These

farmers with strong community ties were less likely to search for individual solutions, but as a group, they did try to enforce their rights to sufficient water, for example by requesting water saving technologies, financed by the state and the European Union. Also a village like Yunquera, which is not so much affected by the water scarcity because of their favourable location upstream, requested for a modernization project which is installing drip irrigation. This technology would also benefit their situation in other aspects: the old farmers wanted to become more 'modern' to give agriculture in this region a future, and it made irrigation practices easier and more flexible – to combine it with other jobs, etc.

Some water users completely lost their access to water in the water scarce periods. Water for environmental flows for example did not exist, although the Spanish government has developed a policy which claims that a certain base flow in rivers should be maintained. But the Junta de Andalucía has made an own water legislation, which states that there are 7 priorities of water use, among which nature is not included, which overrules the national governments policy of environmental flow, as always one of the 7 other water uses claim the available water.

In the following chapter, I will describe 3 case studies which give a more indepth view on the water injustice in the Guadalhorce watershed.

5.1 Rural versus urban

5.1.1 Accumulation

The European Framework Directive obliges that an Environmental Impact Assessment should be carried out before large interventions in an area can start. This Environmental Impact Assessment includes an inventory of the current water users, and a water balance which indicates whether the proposed intervention can take place without hindering existing water use.

In Spain, drinking water has first priority by law. Also from a normative point of view, all interviewed persons agree that every person should have enough water to drink, and some extend that with water for hygienic purposes and water for animals. In practice, the term 'drinking water' means all the water that comes from a tap, and no-one controls for what it is used. As such, households also use drinking water to water gardens, wash cars and fill swimming pools.

Drinking water having the first priority to water means that if someone has plans with a certain water source, which is not exploited yet, one should check which other water users are interested in making use of the same source. If one of these water users has the objective to use this water for drinking water provision, then this water user gets right to using this source. If a source is already in use, it is more difficult to put a claim on this water, even for drinking water companies. In exceptional cases, such as in times of extreme drought, existing sources can be claimed for water provision, this happened for example in the urbanization Alhaurin el Torre, where AquaLauro, the drinking water provider, got the permits to exploit the deep-tube well of Lauro Golf, the neighboring golf course.

This regulation implies that it is important to register as water user, otherwise one's water source could easily be claimed by a user with higher priority. Some water users however have never officially registered their water sources. Water users of traditional irrigation systems for example, might have historical rights, but new requirements are made, which makes the old permits irrelevant. A community with irrigators should register as a Water Users Organization (including all the requirements: a president, secretary and treasurer should be appointed) and can then register their well or off take in the river. Some irrigators never bothered about their registration, as they felt no need to do so. In the last decade, irrigators communities start to register to be able to apply for funds, but otherwise there seems to be no incentive to have their organization on paper: for them it feels more important that they have their organization in practice. However, this gives them a very vulnerable position towards drinking water companies in search for new water sources. In the following case-study, it becomes clear how a prior Environmental Impact Assessment is not always done, and how unregistered irrigators and not identified nature have to fight for their legitimacy.

5.1.2 Conflict

As Malaga cities' demand for water grew, Acuamed, the main instrument of the Junta de Andalucía for drinking water infrastructure implementation, explored the possibilities to enlarge the water reservoirs of EMASA, Malaga's drinking water providing agency. In 2006,

Acuamed identified the Rio Grande as the location where new abstractions should take place: its clean water and relative constant discharge (provided by the aquifer in the calcareous rocks in Sierra de los Nieves) made it an ideal additional source. A dam should be placed at the height of Cerro Blanco, a place near Coin where also small traditional irrigation systems have their intakes in the Rio Grande. Acuamed made their plans public in the newspaper.

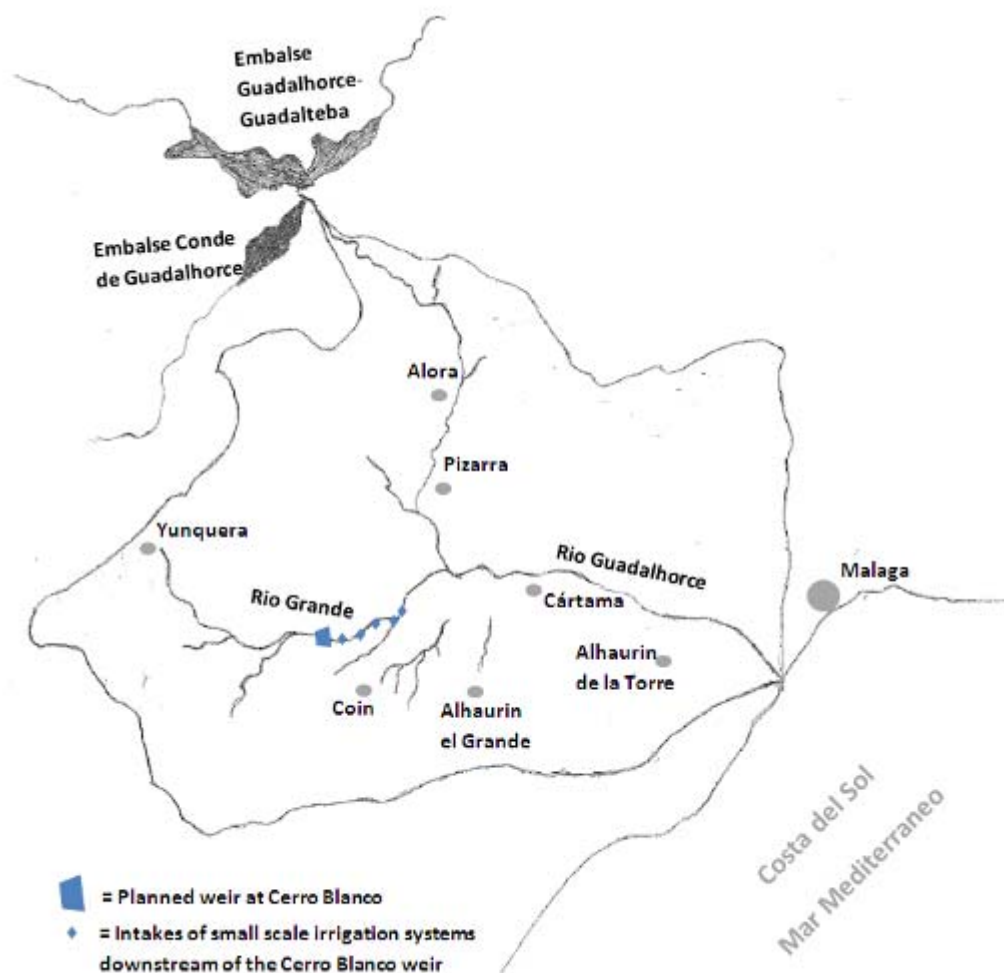


Figure 5, sketch of the area, including the location of the weir at Cerro Blanco.

A group of friends, who used to go hiking in the mountains of the Sierra de los Nieves, heard about the plan and became concerned about the natural character of the Rio Grande. They formed an association, called JARA. Their objective was to protect the Rio Grande, including its natural habitat. They had seen in the Rio Guadalhorce what a disaster damming a river can be for nature, and after reading the project proposal, it became clear to them that this plan would destroy their river: it did not include an environmental study which would make it impossible to determine the needed environmental flow; they noted that the dimensions of the pipelines were designed on the total discharge of the river, not leaving any environmental flow and they feared that the dam would lead to a drying up of the wells downstream, which would lead to a disappearance of the traditional huertas and its

irrigators culture. Additionally, they noted that the words dam and weir were used ambiguously: while making the plans public Acuamed named the construction a weir (a dam lower than 10 meters) while the technical viability study shows that the dam would become higher than 10 meters.

The small group of friends which were all concerned about their environment would alone not be strong enough to protect their river. Instead of focusing only on the environment, they decided to approach the discussion broader. They also involved the irrigators of the traditional irrigation systems in the Rio Grande, who would have to change – or even give up – their practices when a dam would be constructed. More associations collaborated with JARA, together they formed the network *Coordinadora en Defensa del Rio Grande*. This enthusiastic group started discussions on the *feria*, the yearly village event, they set up activities for children, and printed books for school kids to learn about their precious environment. JARA also protested on the streets of Malaga (for which it was hard to obtain a permit). Acuamed, confronted with the large network which protested against the construction of the dam, drew back their plans in May 2007 by confirming the local authorities of Coin and the surrounding villages that Acuamed would not construct a capitation point near Cerro Blanco, but rather at Al Jaima, where Emasa already had a weir for capturing the water at the junction of the Rio Grande and Rio Guadalhorce, which would enable the villages upstream to have their river untouched.

Meanwhile the *Coordinadora en Defensa del Rio Grande* enlarged its network, and started collaboration with the academic world, which made them able to write well-based arguments against the plans for the dam. At time of conducting the interview (September 2009) for example, they were working on their own environmental study of the river to ensure that they are first to describe the ecological state that should be maintained.

At the 8th of January 2009 however, Acuamed made an announcement (BOJA) in the local newspaper, stating that they would start the construction of the dam at Cerro Blanco. Disillusioned, the *Coordinadora en Defensa de Rio Grande* started their protests again, which quickly resulted in a corrected announcement in the newspaper of the 16th February. This announcement stated again that the capitation would take place at Al Jaima.

5.1.3 Civil society action

The large objection of the inhabitants of Coin and its surroundings is special for the Guadalhorce Watershed. In the area of the Guadalhorce Irrigation System, farmers do not often have organized protests. This could be due to several reasons: they are not organized well in WUA's; agriculture is not their main preoccupation which makes it difficult to attend protests as one has other jobs to do, and the presence of the Guadalhorce riverbed with its shallow aquifer gives farmers the opportunity to easily reach groundwater resources, which makes them less depended on the Guadalhorce Irrigation System. Furthermore, it is interesting to see that a group of environmentalists have started an organized protest, in which farmers took place as well. Other environmentalist groups, like the national group *Ecologistas en Accion*, are regarded by farmers as too radical, as they also claim a stop on the use of fertilizer. The *Coordinadora en Defensa del Rio Grande* has a broader view, and they had good connections with farmers, and reached them in several ways, for example by

educating their children. As such, this network got supported by different persons, from different backgrounds.

Water users of the Guadalhorce Irrigation System have a different opinion on the construction of this dam. Some ask when the dam will be placed, they hope that this will give Malaga a new source of a higher quality, and more water will remain in the reservoirs for the farmers. Others, closer to the Rio Grande, are afraid that their private pumps will dry up when the river has no flow anymore. But the main difference between the irrigators of the Guadalhorce and those of the Rio Grande, is that the irrigators of the Guadalhorce are linked with EMASA through their shared infrastructure, and that the irrigators of the Rio Grande traditional irrigation schemes could form ties with other actors, independently from Malaga. This makes them able to protest, and to refuse damming of their water source.

Others claim that the defense against the dam is unrealistic. A golf course owner expresses his opinion:

'It would be good to construct new dams. A bit further than Coin they planned to construct one – but ecologists were against because of fish, they could not pass anymore. Ecologists want to use seawater only, it seems, as that is an infinite source. But I would say that a dam is possible. One should consider the fauna, but it should be possible to leave through a percentage for the fauna.'

EMASA is innovative with its technologies, they have a desalinization plant, good measurement devices, their water quality has been improving over the years. However their focus is on the supply side of their work: they innovate with water sources, but they hardly look at the whole water chain. The Coordinadora en Defensa del Rio Grande focuses on this aspect with their protests: they ask for innovations in the whole water chain: why not re-using waste water? Why not limiting water use to certain water uses, and prohibit using it for gardening purposes? Why not improving the infrastructure from the drinking water plant to the households?

5.2 Overexploitation of the urban periphery

“... Groundwater depletion and the host of associated problems pose one of the most daunting challenges that the world faces in the water sector...” (Shah et al, 2000, pp 7)

Groundwater is a difficult resource to control and manage, but the need for groundwater management is high. In the past decades, equipment for drilling wells and pumping up deep groundwater have been improved, which leads to an easier access to groundwater. The fact that governmental control on groundwater is complicated, has several reasons according to Hoogesteger van Dijk and Vincent, 2007. First of all, groundwater technology is often owned by individuals, who are not organized, and who thus do not control each others water use and neither take into account each others needs. That governmental control is often hardly in place, has its origins in the history of water management. In the last century, governments such as Spain focussed on the development of groundwater sources, not on the control of these sources. This priority on resource development also led to limited funds for groundwater control. Furthermore, Hoogesteger van Dijk and Vincent, 2007 propose that groundwater control will also be a problematic task for governments, as they know that much of the agricultural production is owed to groundwater exploitation. Restrictions and regulations would thus lead to unwanted effects on the agricultural sector. In Spain, the massive shift towards groundwater exploitation has taken place as well, and its public planning and oversight are limited. Hernández-Mora et al., 2007, estimate that 15 to 20% of its countries water use comes from groundwater.

5.2.1 Accumulation

The Guadalhorce watershed uses both groundwater and surface water to fulfil its water demands. The main aquifers in the Guadalhorce watershed are, according to Andreo et al., 1996, a shallow aquifer in the riverbed of the Guadalhorce river, and a deep aquifer in the Sierra Blanca and Mijas area. The aquifer in the riverbed of the Guadalhorce, which has a limited capacity, is used for conjunctive water use for irrigation by the farmers in the Guadalhorce Irrigation System, and at Al Jaima, EMASA has a set of pumps to pump up groundwater as well. In the Sierra Blanca and Mijas area, groundwater is used by even more actors. As explained before, Malaga traditionally used 1/3 of the discharge from Blanca-Mijas aquifer, draining from natural springs near Torremolinos. The other 2/3 of the natural discharge of the Blanca-Mijas aquifer were used for irrigation, using Moorish infrastructure (Andreo et al., 1996). Often those springs served as well to power mills (for example for the production of olive oil). After 1970 however, this area close to Malaga became popular for tourist reasons. At the coastal site of the Sierra de Mijas aquaparc were constructed, and at the north/east site of the Sierra de Mijas golf courses started to develop, and urbanisations got constructed to enable the growth of Malaga. To fulfil their water needs, they drilled wells to extract groundwater. A study by Aledo et al., 2000, indicates that in the period between 1990 and 1994 49 hm³ per year was pumped up from the aquifer Blanca-Mijas, of which 12 hm³ per year was used for the irrigation of 2626 hectares and 37 hm³ per year is pumped as drinking water, to supply a population of 280000 inhabitants. In the same period, the unbalance is even more visible in a nearby aquifer of the Sierra de Mijas: of the 31 hm³ per year abstracted (11 hm³/ year more then the recharge of the aquifer), only 4,5 hm³ per

year was used to irrigate a 1400 hectare, while 26, 5 cubic hectometer per year was used to supply the municipalities with drinking water.

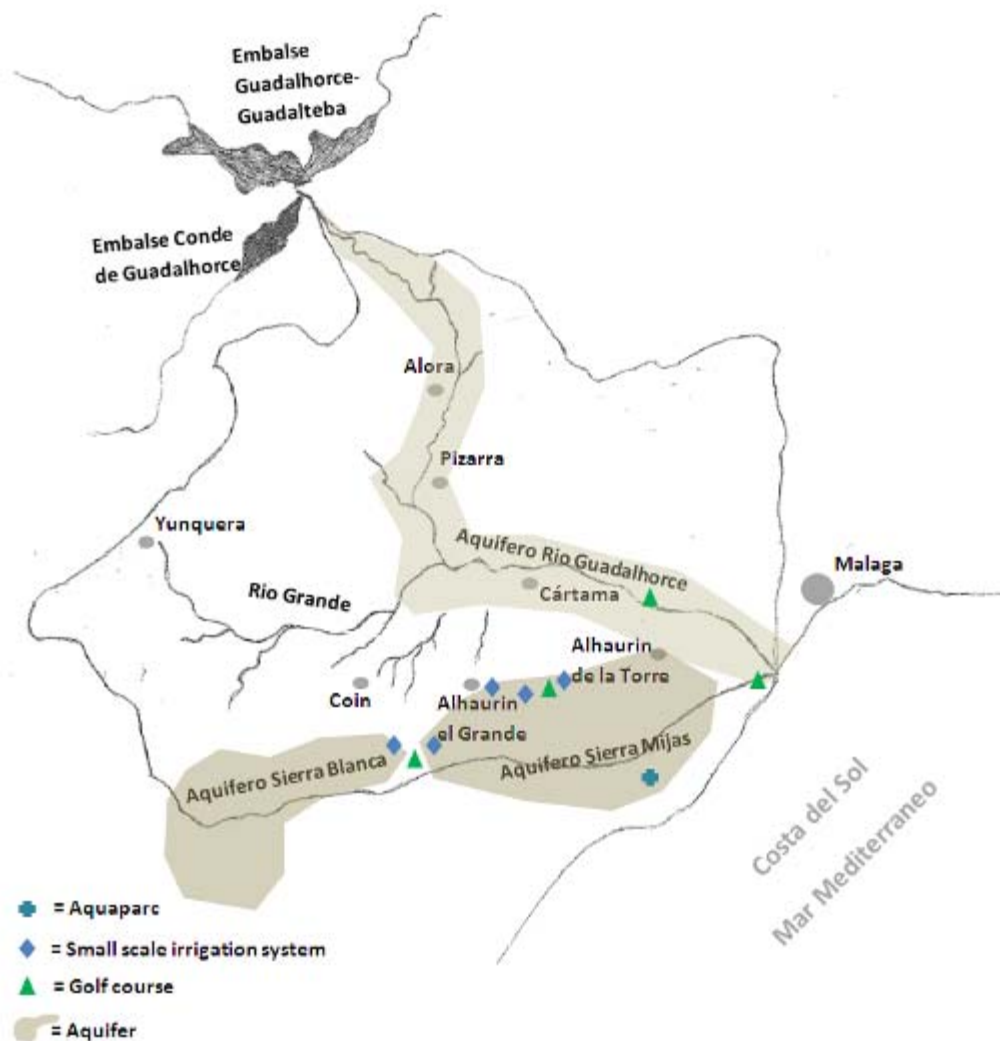


Figure 6, Aquifers in the Guadalhorce Watershed and groundwater users (note: as small scale irrigation systems are often not registered, it is impossible to indicate all of them on a map, in reality there are more than indicated on this map)

As stated before, control on groundwater extraction is limited. The official priority for drinking water is still applicable when applying for a permit, but not all wells and boreholes are registered, and as the dimensions of the aquifer are unknown, no decisions can be made on the available water, thus restrictions are difficult to make. Golf courses and urbanisations, who have a large water demand, do have to get their permit. They have to be able to indicate that their water using activity will lead to economic benefits. In practice, the main limiting factor for the extraction of groundwater is the price of drilling a well. As a result of this, water users with enough capital are able to drill wells, as deep as necessary. Their water extraction causes the water table to lower, which leads to the drying up of natural wells, dug wells and shallow tube wells. The ones who can afford a deep tube well will install one, the ones who can not afford the high prices, have no choice, and will have to do with a limited discharge of their well. As such, water accumulates in the hands of

the water users with sufficient capital and who commonly deploy a discourse that claims economic prosperity for the region with sufficient capital. The traditional farmers in the area are generally not the ones with high income, the companies earning enough to drill expensive wells come from Malaga city, or even from further away.

5.2.2 Conflict

Malaga city is encroaching into the rural area, with urbanisaciones, golf courses and industries, taking over the agricultural area. The Guadalhorce Irrigation scheme has already lost much of its area to the airport and to shopping malls. But the place where this encroachment can best be seen, is the valley of Alhaurin, at the foot of the Sierra de Mijas. This area has been an area which traditionally supplied Malaga of fruits and vegetables: its fertile soils, closeness to Malaga and groundwater from the Mijas aquifer in reach makes it an ideal area for local agriculture.

However, people from abroad and inhabitants of Malaga searching for a quiet place to rest for the weekend have the same criteria: they are looking for an area which is quickly reached from Malaga, and preferably, it should be on a slope, giving the housing a view on the valley. Alhaurin de la Torre, from all the villages in this area the closest to Malaga, has grown enormously the past years, from nearly 13 thousand in 1991, to more than 23 thousand in 2001, and counting a number of 33.567 inhabitants in 2008. The urbanizations, in which the growing population lives, get their water from deep wells, up to a 300 meters deep in the case of Alhaurin de la Torre. They are not the only water users: also tourist attractions make use of the groundwater in the Sierra de Mijas. Within the watershed of Guadalhorce, those include mainly two golf courses. At the other side of the Sierra de Mijas, Torremolinos has highly developed its tourist attractions, such as aqua parks and golf courses. This shift in land use makes land prices in the area high, which makes it almost impossible for young farmers to buy a plot. But also their water use is under pressure. Urbanizaciones and golf courses are both highly profitable, and as such, they have no difficulty with installing expensive deep tube wells. Traditionally, farmers made use of the natural springs from the Sierra de Mijas, but most of these dried up because the growing amount of groundwater pumps in the area, such as in Urique. The irrigators of Urique came together to buy a pump, as every farmer contributed some money they could pay a pump of a 50 meters deep. However, their pump could not compete with the deep tube wells of the newly constructed country houses for foreign investors. Their water extraction – for swimming pools, green lawns and water supply to the houses - kept on growing.

Luckily, the irrigators of Urique have a good relation with the irrigators of El Torre, a neighboring irrigation community whose well was still giving sufficient discharge. They shared the available water with the irrigators of Urique. Unfortunately, the comunidad de regantes de El Torre got the same problem, also their discharge lowered because of the growing ground water competition. Already for 3 times now they had to drill a new, deeper well.

Juan Morena², a retired farmer near the golf course Alhaurin Golf, irrigating with the water from El Torre, explains the impact of Malaga's growing influence in this area on his family's

² The names of informants in the case studies are changed for privacy reasons.

identity. His three sons work in a restaurant, where many tourists come. But Juan Morena does not want them to work only with tourists: he also wants them to know their roots, they need to know the land they come from, and thus, he keeps on cultivating his plots to keep the land in his family. And although the cultivation of his plots is not actually profitable in economic terms, while the tourism industry in which his sons work is, he is not so much in favor of the construction of a newly planned urbanization as he knows that their water source is at risk again. He says: “the only thing we can do, is to buy a deeper pump. It is like preparing for a war, yes, deepening the wells is like preparing for a war...”

5.2.3 Civil Society Action

As Juan Morena indicates, the most logical reaction for a well owner, who notices that the water table in his well lowers, is to drill a deeper well. This individualistic action is the most common, as long as one has enough capital to pay for the installation costs and the higher energy consumption. Collective action against groundwater overexploitation is difficult. The persons who notice that the water table in the aquifer lowers, are also the ones who depend on groundwater, for these water users it is hard to take action as the groundwater overexploitation is also partly due to themselves.

This competition on groundwater, with deepening wells as weapon, has an impact on nature, which depends on natural springs. As the nature can not take action to improve its situation, it needs a spokesman. The researcher Aledo has made an inventory of the Sierra de Mijas aquifer. In his dissertation, he describes the hydro-geological features of the aquifer, but also slightly touches upon the issue of over exploitation. The environmental action group JARA (see case 1) has taken up the research of Aledo to stress the issue of good groundwater management, and also links this to the European Framework Directive, in which guidelines for groundwater management is given. JARA has also developed a dvd movie for children, in which the concept of an aquifer is explained, in order to increase awareness on groundwater depletion and pollution. On the website of the Coordinadora en Defensa del Rio Grande, the complexity is summarized as follows:

‘¿Por qué tenemos que perder nuestras huertas y agua para beber, para fomentar un desarrollo insostenible y discriminatorio?’ (<http://www.riograndevivo.org/alter.htm>)

5.3 Giri's in a local System

In irrigation systems, different methods exist to obtain rights to use water. Depending on the irrigation system, water use rights can be obtained with a financial contribution, or with a contribution in terms of labor and participation.

Within neo-liberal thinking, it is common to expect that one can join a water distribution scheme by buying the right to use water. Moreover, it is expected that this leads to efficient water use. More generally, the notion that fee payment is sufficient to get a water right, is strongly present in water policies. Also most European drinking water distribution systems are set up according to the principle of paying a water fee, either for the connection to the house, or for the quantity of water used.

However, in other places, such as the irrigation systems based on Moorish principles, this does not have to be the only way of obtaining water rights. In Southern Spain, some small irrigation systems are still based on Moorish principles, which are not per definition in line with current water management norms dominating in Europe.

5.3.1 Accumulation

In the irrigation systems in the Guadalhorce watershed different methods to obtain water rights are existent, and they are often a mixture of Moorish, bureaucratic and neo-liberal principles. In the relatively new Guadalhorce Irrigation System, water users pay a water fee and are expected to help in collective canal cleaning activities. More land inwards, in the small traditional irrigation systems, shared by small groups of farmers, the Moorish influence is larger. Sometimes no economic contribution is required at all, but participation in collective action is mandatory. Knowledge of local rules and norms and understanding those is essential to be able to know how to obtain and maintain water use rights.

The Guadalhorce area has a large number of immigrants coming from Northern Europe. In their country of origin, irrigation is hardly present. Often, their only experience with accessing water is through the local drinking water distribution system, and their expectation is that accessing water in an irrigation system would be similar: they would like to access water at the moments that suits them (when it is not their turn, and no water flows through their canal, they call it a 'water cut off' without knowing that the water will be flowing in another canal), and they expect to get a water bill after a while.

Some newcomers try to get involved in the Spanish culture, they learn Spanish and ask neighbors about the rules in use. However, the persons who integrate in the Spanish culture are rare. There is a general disinterest in integrating, as most do not come to meet a new culture, but rather to enjoy the sun and the profitable financial climate. The ones who do manage to take Spanish lessons remark that the inhabitants of the inland speak a different dialect, which is not similar to the Spanish in text books. In addition to these problems, the Spanish seem to be hardly open to newcomers, as they have few positive experiences. All these hurdles lead to a misunderstanding of the rules in use within the local societies in the Guadalhorce area. Misunderstandings exist for example on: building permits, primary school activities, sun bathing in public and also in the irrigation scheme. The immigrants would like to have access to irrigation water: to water their gardens and to fill swimming pools. Because of the difficult communication, most immigrants 'just use the water when it passes by our garden' as a British informant stated. This leads to malfunctioning of water

distribution systems, and in the longer term, this also affects collective action. In areas where many immigrants live, collective maintenance of the canals is already lacking as also the Spanish farmers stop their collective activities when they see that others do not participate.

5.3.2 Conflict case

In the Rio Grande sub watershed, with a long history of irrigating, informal regulations dominate the daily practices. The following, small-scale case is just an illustration of common, widespread conflicts in the region.

The group of 12 water users of the Manantial del Reina in Yunquera is a small, informal Comunidad de Regantes. These water users are not registered by Spanish water law, neither is their source. The source gives a discharge of 10 liters per second, and is not considered important enough to legalize. However, without the water from the Manantial del Reina, the 12 farmers wouldn't be able to irrigate their terraces with vegetables. Besides that, most of the irrigators are retired, spend their days on the fields and as such, irrigation practices are an important element in their lifestyles.

The rule-in-use to obtain an irrigation turn, is that one will walk along the acequia – small canal - towards the source. It could be that one will encounter an irrigating neighbour on the route, then one should line up to get his share. If not, he goes up to the source, diverts the water from the arroyo to the acequia, and he takes his turn, which is unlimited in time. Because of the smallness of this group and the good communication among them, the water distribution normally doesn't cause many problems.

However, since half a decade, one of the farmers owning a cowshed and a field where he cultivated fodder and some fruit trees, sold his land instead of inheriting it to his children. He sold his land to a woman from the UK, who rehabilitated the cowshed and made it into a country house. This is not a unique case: since some seven years ago the road from Malaga to Yunquera got improved and more foreigners decided to move away from the Costa del Sol, where house prices are high, towards the inlands, which are still within an hour drive of Malaga.

Karen, the woman who bought the cowshed, was fed up with England, and decided that the warm climate of Spain, its attractive tax system and the slow life and easy life of Andalucía, would make her happy. She checked with some English friends to know how the irrigation system works. These friends form part of another irrigation system as they live in another part of the village, but neither the friends, neither Karen expected that they would be part of an other irrigation system. In Yunquera many different springs exists, al with their own, site specific regulations. As the friends were allowed to irrigate every Tuesday and Thursday, she kept in mind that she was allowed to use water every Tuesday and Thursday as well. She used these days to water her flowerbed and some of the fruit trees if water passed through the canal.

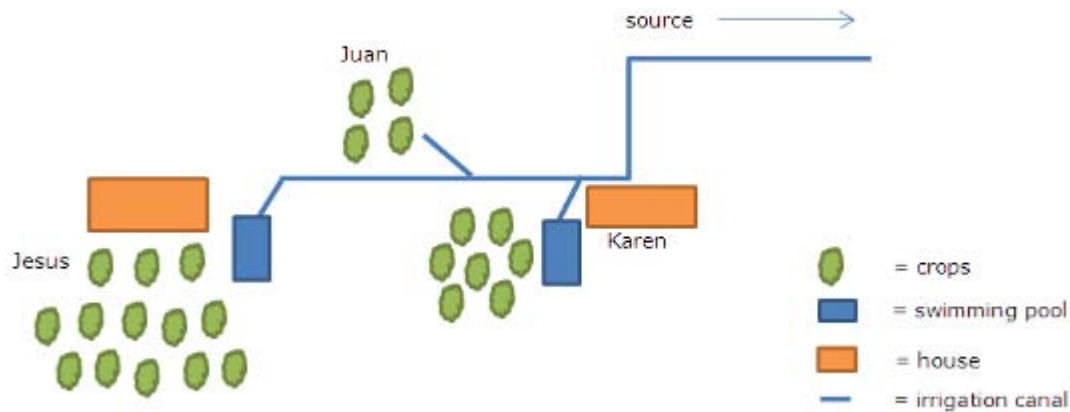


Figure 7, sketch of the situation

Often, Spanish neighbours passed by. According to her, they accused her of gardening and planting flowers. As a woman, she felt uncomfortable in the male-dominated countryside. According to these Spanish neighbours, they tried to inform her that they were irrigating, downstream of the canal, and now she blocked the canal during their turn! But because of the difficulties with the language, they did not understand, and neither came to a solution.

The situation worsened in 2008, when Karen's neighbor Jesus constructed a swimming pool, and Karen decided to turn her small water reservoir into a swimming pool as well. Jesus wanted his grandchildren to come more often to visit him and his country house, and Karen had invited her niece to come over to enjoy a summer in Spain. Now suddenly, both wanted to fill up their swimming pool before the weekend, and with the small quantity of 10 liters per second coming from the natural source this isn't done so quickly. Jesus, who had asked for his irrigation turn upstream, claimed his turn. Karen, who saw the water passing by, blocked the canal and opened her gate.

Jesus got furious, and blocked her canal again. Karen, willing to fill up the swimming pool before her niece came, opened her sluices again.

The following night, after dark, Jesus did not go up to the source again as he normally should do to block of the canal and divert the water to the stream. He diverted the water towards Karen, not to fill her pool, but to flood her patio.

The next morning, the water had even entered her house, causing much damage. According to Jesus, this was the only way to make her see that one should think about when to use water, and when not.

According to a neighbor of the two (Juan), who has borrowed a small piece of land of his cousin, their fights have caused him troubles of getting his share of water. While Jesus and Karen fight, he doesn't want to get involved. As he does not intervene, he is not able to use water either. His only solution is to check with every foreign-looking passenger, whether they speak both Spanish and English: he wants someone to tell Karen in English how the practice of walking up to the source to ask ones turn works, and that she should follow this

rule-in-use as well. But, he says: it isn't easy to communicate with her, and even more, she is a woman!

The difficult relation with foreigners, also called *giri's*, does not only occur in Yunquera. Also in the Guadalhorce valley, many houses are constructed in the agricultural fields, which breaks up the communication between local irrigators. Most of the UK- immigrants come to the Costa del Sol for similar reasons such as Karen's; their main objective is not to integrate in the local community or to practice agriculture. This makes their interests in water use quite different. And because many of the *giri's* are retired, they are not always able to learn a new language and to understand a new system. It is not that they do not like to irrigate. Bill, for example, will tell you how passionate he is about walking through the fields of oranges, guiding the water with his *how*. But he is also the one who will get grumpy when his irrigation turn falls on a Sunday evening when he is just having his English tea: it should be a hobby, he came to Spain to relax.

5.3.3 Civil Society Action

Not only the *giri's* have problems with understanding local practices. Clashes exist also between local irrigators and *domingueros*. The irrigation practices in the Guadalhorce watershed are complicated as they are mixtures, adapted locally to circumstances. Collective action to avoid clashes between local irrigation practices and new water users is not taking place. In some cases, like the situation with Jesus and Karen, the problems get to big which causes a visible clash. More often, water users do not openly contest the new water users, but rather gossip about them, and spy on them. Collective irrigation systems start to individualize, which makes collective action end, and irrigators find their own way of assuring themselves with enough water – for example by installing wells, or by using drip irrigation.

Another plausible reaction of the water users, confronted with individuality and globalization, would be to form even stronger communities, who close themselves for any influence. However, in the Guadalhorce watershed, it is impossible to ignore the influences from outside. And as the prior case with Juan Morena indicated, inhabitants of the Guadalhorce Watershed are also depended on the *domingueros*, *giri's* and tourists: it is also a source of income. It might not directly influence their income, but everyone has family who work in the tourist of construction sector, and as such, complaining too much about the foreigners would cause a loss for them.

6 Conclusion

In the Guadalhorce Watershed, water management is organized around the neoliberal principle that water flows are distributed according to economic interests. This has as a consequence that cities, urbanizations and golf courses have access to enough water. As the agriculture in the region cannot compete on the world market, agricultural incomes are low, and their access to water is limited. This is not only due to their low economic importance: it is also caused by the malfunctioning of water users organizations, and their lack of representation. The water users organizations hardly exist, as the water users are a heterogeneous group with diverse interests. Moreover, organization in WUA's also implies for the water users in the Guadalhorce Irrigation System a responsibility to maintain the deteriorated irrigation infrastructure, which is a disincentive for water users to collaborate. Water users in small scale irrigation systems along the Rio Grande do organize themselves, but not all register themselves formally, which makes them vulnerable for competing claims on their sources from drinking water companies, as their non-registration leads to a neglect of their historic water rights.

Conflicts in this area often separate water users in 'locals' and 'non-locals': the competition over water amplifies the differences between Malaga city and the inlands, between Andalucía's and the rest of Spain, and between local farmers and 'giris', the sun-admiring immigrants. However, exactly because of this mixture in backgrounds, it is difficult for the water users to collaborate, and in conflict cases individual acts to solve the conflict are more common than collective action. As such, a common solution is to drill wells, which temporarily solves the problem for the individual water user, but which worsens the problem of over exploitation of the aquifers. One exception shows how the organization of water users (both farmers and environmentalist) can be very strong: in the Rio Grande, the group JARA linked different actors together and prevented the construction of a water intake in the Rio Grande for Malaga's drinking water need.

References

- Andreo, B., F. Carrasco, F. Catalan, J.J. Duran, G. Fernandez del Rio, L. Linares, G. Lopez Arechavala, J.A. Lopez-Geta, R. Mayorga, L. Trenado I. Vadillo. Características hidrogeológicas de las Sierras Blanca y Mijas y del Bajo Guadalhorce. In: *Aportaciones al Conocimiento de los acuíferos Andaluces, Libro Homenaje a Manuel Del Valle Cardenete*, ed. Juan Carlos Rubi Campos and Juan Antonio Lopez Geta, Malaga, 2002
- Bakker K, 2002, "From state to market?: water mercantilización in Spain" *Environment and Planning A* 34(5) 767 – 790
- Bleeker et al, 2006
- Boelens, R. 2008, Water rights arenas in the Andes: Upscaling the defence networks to localize water control. *Water Alternatives* 1 (1): 48-65
- Latour, B. 2005. *Reassembling the Social. An Introduction to Actor-Network-Theory*. New York: Oxford University Press.
- Hernández-Mora, N., Martínez Cortina, L., Llamas, M.R. & Custodio, E. (2007). Groundwater issues in southwestern EU member states: Spain country report. European Academies of Sciences Advisory Council (EASAC). Fundación Areces. Madrid.
- Hoogesteger van Dijk, J., L. Vincent, 2007, *Is participatory Groundwater Management and Option?* Paper presented at the 4th Asian Regional Conference & 10th International Seminar on Participatory Irrigation Management, Teheran, Iran.
- Junta de Andalucía, 2008. Consejería de Agricultura y Pesca, propuesta de actuación en la zona regable del Guadalhorce, Malaga
- Justicia Hídrica 2009, Informe aportes conceptuales y estratégicos para la implementación del proyecto Justicia Hídrica. Resultados del Encuentro de Investigadores realizado el 22 al 27 de Noviembre 2009, Cusco Peru
- Roberts, C. R. (2002), Drought management in the Río Guadalhorce region of Andalucía, southern Spain. *Land Degradation & Development*, 13: 151–163. doi: 10.1002/ldr.486
- Sayer, A. 1992. *Method in Social Science. A realist approach*. London, UK and New York, USA: Routledge
- Shah, T.; D. Molden, R. Sakthivadivel, D. Seckler. 2000. *The global groundwater situation: Overview of opportunities and challenges*. Colombo, Sri Lanka: International Water Management Institute.
- Vos, B. 2001 The Future of Agriculture in Areas of Tourism, A case study of Irrigation and Management Transfer in Andalusia, Spain. Thesis for Master of arts Degree, Nijmegen and Wageningen